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South Carolina Food Stamp and Well-Being Study

Well-Being Outcomes Among Food Stamp Leavers

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Abstract

This study examines data from a survey of families in South Carolina who left the Food Stamp Program (FSP) between 1998 and 2000. We combined the survey data with earnings data and subsequent food stamp receipt to investigate personal and family characteristics associated with three types of well-being outcomes: food hardships, other adverse events, and subjective assessments of life changes. Study results show that families with rising incomes are less likely than families with lower incomes to experience food hardships or other adverse events or to have a negative view about life changes. Families who return to the FSP are more likely to experience food hardships and other adverse events but are less likely to have a negative view about life changes than families who remain out of the program.

Keywords: Food stamps, food insecurity, subjective and material well-being, MIMIC models

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Food Assistance & Nutrition Research Program

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South Carolina Food Stamp and Well-Being Study: Well-Being Outcomes Among Food Stamp Leavers

1. Introduction

Food stamp caseloads in South Carolina and the rest of the nation fell sharply during the late 1990s. From 1996 to 2000, the average number of households receiving food stamps each month in South Carolina dropped 15 percent from 143,000 to 122,000. Nationally, the drop was even larger, 31 percent from 11.1 million households to 7.3 million (Cunnyngham 2001). These enormous declines have been attributed to several factors, including favorable economic conditions, programmatic changes in food stamps and other assistance programs, and individual behavior (USDA 2001). The different reasons for the decline, in turn, have different implications for the well-being of those who left the program. Households that left voluntarily because of better economic opportunities or other personal reasons most likely improved their well-being, while households that were sanctioned off the program or left for other administrative and programmatic reasons may have suffered increased hardships.

Concerns about the well-being of food stamp leavers prompted the U.S. Department of Agriculture (USDA) to commission surveys of different groups of leavers in four states: Arizona, Illinois, Iowa and South Carolina. Evidence from the surveys indicated that hardships were common among leavers.[1] Jensen et al. (2002) reported that nearly half of the leaver households in Iowa were food insecure, and slightly more than half had turned to using private food assistance in the time since leaving the program. Mills and Kornfeld (2001) and Richardson et al. (2003) similarly reported that just over half of the households that they surveyed in Arizona and South Carolina, respectively, experienced food insecurity after leaving the Food Stamp Program. In contrast, Rangarajan and Gleason (2001) reported that only one-quarter of leaver households in Illinois were food insecure but that three-fifths had experienced at least one severe hardship two years after exiting the program. The incidence of food insecurity reported by Jensen et al. (2002), Mills and Kornfeld (2001) and Richardson et al. (2003) is nearly identical to the national incidence of food insecurity among food stamp recipients around this time of 52 percent (Nord et al. 2002), while the figure reported by Rangarajan and Gleason (2001) is comparable to the national incidence for low-income non-recipients.

Our study looks closely at the survey information from South Carolina to examine characteristics of leaver households that are associated with three domains of well-being: food hardships, other adverse events and subjective assessments of life changes since leaving food stamps. The survey that we examine interviewed leaver families who had children and who had not participated in the TANF program while on food stamps. Unlike the studies listed above,

[1] Dagata (2002) summarizes results from this research.

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which provide general figures and some cross-tabulations of well-being outcomes, we conduct detailed multivariate analyses of these outcomes.

Each of the domains of well-being in the South Carolina survey is measured by several questions. Following the practice of most previous studies in this area, we examine summary measures, such as indicators for whether any adverse events occurred and counts of the number of events that occurred. However, because of the limitations of some of these measures, we also develop and estimate Multiple Indicator, Multiple Cause (MIMIC) models of the outcomes. The specifications for these models incorporate a measurement model that relates the responses from the relevant questions to an underlying index of well-being; they also incorporate a multivariate behavioral model that describes how a set of explanatory variables affects the index. MIMIC specifications have been used in numerous other contexts; however, to our knowledge they have not been widely used in food assistance research.

The rest of this report is organized as follows. The survey that we examine and variables that we drew for our empirical analyses are discussed in Section 2. In Section 3, we report results from cross-tabulations of how well-being outcomes varied across households with different economic and demographic characteristics. In Section 4, we describe our multivariate statistical models, including the MIMIC models, and report results from these models. Discussion and conclusions follow in Section 5.

2. Data

The data for our empirical analyses come from a survey of South Carolina families who had been former food stamp recipients but who had not received TANF while on food stamps. The survey was conducted by Maximus, Inc. for the USDA and the South Carolina Department of Social Services (SC DSS). Details of the survey procedures are discussed in a report by Richardson et al. (2003), so we only briefly summarize the methodology here. Readers who are interested in more information about the survey along with a complete descriptive analysis of the data may wish to consult the earlier report.

As reported by Richardson et al. (2003), Maximus, Inc. conducted phone interviews with two cohorts of South Carolina families: one group that had left the Food Stamp Program during the fourth quarter of 1998 or first quarter of 1999 and another group that left the program during the fourth quarter of 1999 or first quarter of 2000. The interviews occurred approximately one year after the families left the program. For each cohort, 644 families were selected for interviews. The families all had children present when they were receiving food stamps, and none had received TANF at any time during the year before they had left food stamps. Families were equally stratified between one- and two-parent households. Of the 1,288 families that were selected for interviews, 899 (or 70 percent) completed interviews. There were no significant differences in completion rates between cohorts or between one- and two-parent households.

Material and subjective well-being measures. Different questionnaires were used depending on whether the families were receiving or not receiving food stamps at the time of the interview. The well-being outcomes that are the focus of our study—food hardships, other adverse events, and subjective assessments of life changes—were only asked of families who were off food stamps. Slightly more than three-quarters of the responding families were not receiving food stamps and thus asked the questions. The different design issues lead to a selective sample that consists of non-TANF, food stamp leavers who were off the Food Stamp Program a year later and reachable by phone. It is important to keep this selection in mind when interpreting the results.

The survey asked multiple questions about each category of well-being. We discuss the categories and the associated items below. Some of our multivariate statistical analyses work directly with the individual items. However, our descriptive analyses and some of our other multivariate analyses work with summary measures built from the individual items. Because of this, we also discuss how the summary measures are constructed.

Food insecurity. For the food insecurity questions, respondents were asked to think about their "food situation" over the previous two years. They were then asked whether or how often any of the following happened:

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Q1: The food that I bought just didn't last, and I didn't have money to get more.

Q2: I couldn't afford to eat balanced meals.

Q3: Did you ever cut the size of meals or skip meals because there wasn't enough money?

Q4: (If Q3 occurred in last year): How often did you cut the size of meals or skip meals in the past year?

Q5: Did you ever eat less than you should because there wasn't enough money to buy food?

Q6: Were you ever hungry but didn't eat because you couldn't afford food?

For all of the questions except for Q4, subjects could respond that the conditions did or did not occur. If a particular condition did occur, the subjects were then asked whether it happened in the last 12 months, before the last 12 months or during both time periods. For each of these questions, we create a binary (dummy) variable that takes on a value of one if the person reported experiencing the problem in the last 12 months or in both time periods and takes on a value of zero otherwise. Question Q4, which was only asked of people who responded affirmatively to Q3, asked how frequently people cut the size of meals or skipped meals. For this question, we create a binary variable that equals one if the respondent indicated that this happened more frequently than "one or two months" a year.

Our primary multivariate analyses employ Multiple Indicator Multiple Cause specifications that combine and jointly model the individual responses to all six food hardship questions. However, in our descriptive analyses and in some preliminary multivariate analyses, we also consider two summary measures of food hardships. The first of these follows the methodology described by Nord et al. (1999) and uses the count of affirmative responses to the food hardship questions to form a food security scale. Specifically, people who indicated that they either experienced no hardships or only one type of hardship are classified as *food secure*, meaning that they had access "at all times to enough food for an active, healthy life" (Nord et al. 2002). People who indicated that two to four of the hardships occurred are classified as *food insecure with no hunger evident*, meaning that at times "they were uncertain of having, or unable to acquire, enough food to meet basic needs for all household members because they had insufficient money and other resources for food" (Nord et al. 2002) but that they avoided the physical problems of hunger. People who indicated that five or six of the hardships occurred are classified as *food insecure with hunger evident*.

The second summary measure is just the count of affirmative responses to the hardship questions. While counts of hardships are commonly used in well-being research and are examined in our report mostly for comparative purposes, we need to be mindful of their potential drawbacks. For one thing, a raw count of affirmative responses may not take account of the different severities of different conditions. A household whose only affirmative response is to question Q6, may experience a different level of hardship than a household whose only affirmative response is to question Q1. This specific pattern of response is very rare, but it can occur. Another issue with the count measure involves the interpretation of the implied scale. The difference between no affirmative responses and one affirmative response may mean something different than the difference between one response and two or between five responses and six. By comparing results from the individual food hardship items, the food security scale, and the simple count measure, we can see whether our estimated relationships are sensitive to these measurement and scaling issues.

In the survey, 50 percent of the leaver families who were still off food stamps one year later were food secure; 37 percent were food insecure without hunger evident, and 13 were food insecure with hunger evident. Nationally, in 2000, 84 percent of all households with children were estimated to be food secure, 12 percent were food insecure without hunger evident, 4 percent were food insecure with hunger evident (Nord et al. 2002). Nationally, among households with incomes less that 130 percent of the poverty line, 31 percent were food insecure without hunger evident and 11 percent were food insecure with hunger evident (Nord et al. 2002).

Other adverse events. In addition to the food security questions, families who were not receiving food stamps at the time of the survey were asked whether they experienced any of 14 other adverse events. Some of the events were not applicable to all families, because they focused on problems specific to younger children (problems arranging child care) or specific to older children (children's run-ins with police). Two other events occurred rarely. One of these (going to a homeless shelter) could be logically combined with another category (having to move; see condition A1 below). Another event (sending children to live with someone else) could not be combined with another category and was dropped. The events that we consider are:

A1: Did you ever have to move because you could not pay for housing? Or did you have to go to a homeless shelter? (Combines two items)

A2: Have you ever gotten behind in rent or other payments for housing?

A3: Did you ever get behind on a utility bill?

A4: Did you ever go without electricity in your home?

A5: Did you ever go without heat in your home?

A6: Did your water ever get cut off?

A7: Was your telephone ever cut off?

A8: Did a car or truck ever get taken away because you could not keep up with payments?

A9: Was somebody in your home ever sick or hurt when you couldn't get medical care?

The survey first asked whether each of the adverse events occurred and then asked whether they occurred during the previous 12 months. As we did with the food security items, we created a dummy variable for each condition and set it equal to one if the person reported experiencing the event in the last year. In our multivariate analyses, the nine individual indicators are examined together using a MIMIC specification.

Figure 1. Definitions of Household Food Insecurity from 6-item Scale

Food insecurity category	Definition	Affirmative responses to Q1-6
food secure	During the last 12 months, the household had access at all times to enough food for an active, healthy life.	0-1
food insecure with no hunger evident	During the last 12 months, the household was uncertain of having, or was unable to acquire, enough food to meet basic needs for all its members because they had insufficient money and other resources for food. However, the members did not experience reduced food intakes.	2-4
food insecure with hunger evident	During the last 12 months, the household was uncertain of having, or was unable to acquire, enough food to meet basic needs for all its members because they had insufficient money and other resources for food. One or more members experienced reduced food intakes.	5-6

We also used the indicators of adverse events to construct two summary measures: a binary indicator for whether any of the events occurred and a count variable of the number of different types of events that occurred. From the survey, 31 percent of families reported experiencing none of the adverse events listed above; 23 percent reported experiencing one of the events; 19 percent reported experiencing two events; 13 percent reported experiencing three events, and 14 percent reported experiencing four or more events.

<u>Changes in subjective assessments of well-being</u>. Families who were off the Food Stamp Program were also asked three questions regarding how their personal assessments and concerns about themselves and their families had changed over the previous year. Specifically, people were asked whether they agreed or disagreed with the following statements:

S1: You feel better about yourself now than you felt about yourself a year ago.

S2: You worry more about your family now than you did a year ago.

S3: You feel more stress now than you did a year ago.

We used the responses to these questions to form binary indicators of adopting more negative assessments (disagreeing with statement S1 and agreeing with statements S2 and S3). From the survey, 14 percent of the respondents indicated that they felt worse about things compared to a year earlier, 54 percent indicated that they worried more about their families, and 47 percent reported that they felt more stress. We do not form a summary measure of the changes in subjective assessments.

Other measures. Along with the material and subjective well-being measures, the survey collected information on economic and demographic characteristics of the families. Families were asked to report their total monthly income from all sources except TANF and food stamps. Categorical responses were recorded for $0, $1-499, $500-999, $1,000-1,499, $1,500-1,999, and $2,000 or more; a separate category was set aside for the 48 families who either did not know or refused to divulge their incomes.

The survey also asked people whether they were currently working for pay. If the respondents were not working, they were asked whether they had worked in the last year. The respondents were also asked about their age, race, gender and education. They were also asked about the number of preschool-age children, school-age children, and adults (other than their spouses or partners) living with them.

The original sampling frame for the survey was drawn from caseload management records maintained by the SC DSS. Case identifiers were used to link the survey responses to administrative data from the SC DSS on the family's food stamp use. After some analysis of different program history measures, we settled on two: an indicator for the proportion of days during the 12 months immediately preceding the interview that the family received food stamps and an indicator for the proportion of days during the 12 months before that (13-24 months before the interview) that the family received food stamps. The first measure indicates whether and how long the family received food stamps after initially leaving the program; the second measure indicates how much they relied on the program during the year of their initial spell.

With the case identifiers in the data, we were also able to link the survey responses to earnings records from South Carolina's Unemployment Insurance (UI) system. As with the food stamp program history measures, we created two UI earnings history measures: one variable for the total earnings in the four quarters immediately preceding the interview and another variable for the total earnings in the four quarters before that. In some analyses, we also examine UI earnings in the quarter immediately preceding the interview and earnings in the three quarters before that. Although the UI records are useful for describing people's employment and earnings histories, it is important to recognize their limitations. The records only describe jobs covered by the UI system. As such, they miss some types of public and agricultural employment as well as some self-employment and informal employment. In addition, the records only describe employment that occurs in the state of South Carolina and thus miss work that occurs in other states.

Table 1 lists the means of the measures that are used in our empirical analyses. The estimates indicate that, on average, the families in our study are disadvantaged. As mentioned, half of the families reported being food insecure, and more than two-thirds reported experiencing at least one other adverse event. The survey respondents were mostly female; just over half were black, and nearly a quarter had not completed high school. The average reported monthly income was between $500 and $1,000, and the average amount of UI earnings in the previous year was just over $8,000. Despite the disadvantages that they faced, the families had spent only 7 percent of the preceding year (just under one month), on average, back on food stamps.[2]

Data quality. The availability of the UI earnings data allows us to check the quality of the income and work data from the survey. Results from these comparisons are shown in Appendix A. The general associations between the survey and administrative measures are in the directions that we would expect—the amount of UI-covered earnings is positively associated with reported income, and the incidence of UI-covered employment is positively associated with work status. When we look more closely at specific results, however, there appear to be some reporting inconsistencies. Average UI earnings do not increase consistently (monotonically) with reported income. For example, people who reported not receiving any monthly income had higher UI earnings, on average, than people who reported receiving $1 - $499 in income. Similarly, people who reported receiving $1,500 - $1,999 in income had higher UI earnings than people who reported receiving $2,000 or more in income.

Discrepancies also appear for the work status measure. Over a quarter of the people who reported not working at all in the previous year had UI earnings—18 percent in the previous quarter and 9 percent in the preceding three quarters. The comparison of survey and administration data indicates that the responses from the survey need to be interpreted cautiously.

[2] This low rate of recidivism and program use is partly an artifact of omitting families who were receiving food stamps at the time of the survey.

Table 1. Variable Means – Analysis Sample

Measure		Mean
Food hardships		
Food did not last; could not get more	(Q1)	0.60
Could not afford to eat balanced meals	(Q2)	0.45
Cut the size of meals or skipped meals	(Q3)	0.27
Cut the size of meals or skipped meals *often*	(Q4)	0.21
Ate less than person should have	(Q5)	0.26
Ever hungry but did not eat	(Q6)	0.09
Food insecure (2 or more hardships)		0.50
Food insecure with hunger evident (5 or 6 hardships)		0.13
Count of food hardships		1.89
Other adverse events		
Had to move or go to a homeless shelter	(A1)	0.10
Fell behind in rent	(A2)	0.40
Fell behind in utilities	(A3)	0.47
Went without electricity	(A4)	0.10
Went without heat	(A5)	0.07
Water cut off	(A6)	0.07
Telephone cut off	(A7)	0.31
Car/truck taken away	(A8)	0.09
Could not get medical care	(A9)	0.11
Any adverse events		0.69
Count of adverse events		1.72
Changes in subjective assessments of well-being		
Feel worse about self	(S1)	0.14
Worry more about family	(S2)	0.54
Feel more stress	(S3)	0.47
Explanatory variables		
Age		32.17
Male		0.12
Black		0.55
Completed high school		0.74
Second year of survey		0.48
Number of preschool-age children		0.47
Number of school-age children		1.53
Number of other adults		0.26
Two-parent household		0.53
Total monthly income (0-5; missing = 0)		2.57
Income missing		0.08

Currently working	0.69
Not currently working, but worked in last year	0.13
UI earnings in last year (/$1000)	8.32
UI earnings 13-24 months ago (/$1000)	6.38
Food stamp participation in last year	0.07
Food stamp participation 13-24 months ago	0.66
Number of observations	646

Note: Statistics calculated from survey of former food stamp families in South Carolina (Richardson et al. 2003).

3. Descriptive analysis of well-being outcomes

We begin our empirical analysis by examining how food hardships, other adverse events, and subjective assessments of life changes vary with income, work status, and marital status. Table 2 reports conditional averages of several of the well-being measures. The first three columns of Table 2 list statistics from the six-item food insecurity scale, including the percentage of households that report being food insecure, the percentage of households that report being food insecure with hunger, and the average number of affirmative responses among the underlying items. The next two columns list estimates of the percentage of households that reported experiencing any of the nine other adverse events and the average number of events they experienced. The last three columns report the percentages of household respondents that reported feeling worse about themselves, worrying more about their families, and feeling more stress since exiting the Food Stamp Program twelve months earlier.

The first seven rows in Table 2 report these statistics separately depending on people's responses to the total monthly income question. Reports of food hardships generally decline with income, though the pattern is not entirely uniform. For example, families with monthly incomes of $500-$999 report more food hardships than families with slightly lower incomes. Reports of other adverse events initially increase with income but fall thereafter. Similarly, negative subjective assessments of life changes initially increase with income but generally fall thereafter. The patterns mostly fit the expected result that hardships should be negatively associated with income. However, there are deviations, which may reflect misreporting in the income measure or may be a result of not accounting for other characteristics of the respondents and their families.

The next three rows report statistics separately for respondents who reported that they were currently working, those who were not currently working but had worked in the last year, and those who had not worked in the last year. Food hardships, other adverse events, and negative assessments of life changes are all lower among respondents who were currently working than among those who were not working. However, when we examine differences in problems between people who had been out of work for at least a year and those who had worked more recently, there is no consistent pattern.

Because of possible reporting problems in the work status measure, we repeated the analysis using UI covered-employment data. The next three rows from Table 2 report statistics separately for respondents with any covered earnings in the preceding quarter, respondents with any covered earnings in the previous three quarters, and respondents with no covered earnings in the preceding year. The associations based on the UI measures are similar to those based on self-reported work status, just slightly attenuated. Thus, the observed differences between working and non-working respondents and the absence of consistent differences between those who recently stopped working and those who had not worked in a year appear to be genuine. One possible explanation for the latter pattern is that people's perceptions of problems may adjust

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over time after losing a job, even if there is no objective improvement in their material well-being. Another explanation may be reverse causality, with people who perceive fewer problems being less motivated to find a job.

The final two rows of Table 2 list statistics that were calculated separately for one- and two-parent households. Bauman (1999), Lerman (2002a,b), Ribar (2005) and others have found that reports of food hardships, material deprivations and financial strains are lower among two-parent households than one-parent households, even when income and other characteristics are accounted for. However, we do not see that pattern in the South Carolina survey data. For several measures, including the indicators for food insecurity with hunger and for experiencing any adverse events, one-parent households are slightly more likely to report problems, but for other measures, they are slightly less likely to report problems. Thus, the presence of an additional parent does not appear to be protective in these data.

Table 2. Cross-tabulation of Well-being Measures and Household Characteristics

	6-item food insecurity scale			Other adverse events		Changes in subjective assessments		
	Percent food insecure	Percent food insecure with hunger	Average count of hardships	Percent experiencing any events	Average count of events	Percent who feel worse	Percent who worry more	Percent who feel more stress
Total monthly income								
$0	59.3	14.8	2.22	63.0	1.52	25.9	63.0	55.6
$1-$499	51.2	14.6	2.00	82.9	2.37	29.3	70.7	61.0
$500-$999	53.7	15.3	2.12	72.3	2.06	14.1	58.8	51.4
$1000-$1499	51.5	12.6	1.91	70.7	1.67	12.1	57.1	47.5
$1500-$1999	47.7	15.1	1.84	67.4	1.57	14.0	46.5	44.2
over $2000	42.4	6.1	1.44	53.0	1.11	3.0	31.8	37.9
Don't know / refused	39.6	6.3	1.35	68.8	1.38	12.5	54.2	33.3
Work status								
Currently working	47.5	11.1	1.79	68.1	1.66	10.0	48.9	42.8
Worked in last year	54.1	17.6	2.13	72.9	1.78	25.9	72.9	62.4
Did not work in last year	56.9	15.5	2.09	70.7	1.90	19.0	62.1	53.4
UI status								
UI in current quarter	49.4	13.1	1.88	68.3	1.75	11.9	53.4	47.1
UI in last year	52.5	11.5	1.90	85.2	1.74	23.0	59.0	47.5
No UI in last year	51.0	12.4	1.91	65.4	1.65	15.0	55.6	47.7
Marital status								
Single parent	49.3	15.5	1.94	69.7	1.68	14.8	53.6	47.7
Married parent	50.7	10.3	1.84	68.7	1.76	12.7	55.2	46.9

Note: Statistics calculated from survey of former food stamp families in South Carolina (Richardson et al. 2003).

4. Multivariate analyses of well-being outcomes

Modeling considerations. As we have already discussed, each of the well-being outcomes that we examine is measured using a series of related indicators. For our multivariate analyses of these outcomes, we must consider whether and how best to combine the information from the individual items. There are several things to consider. On the one hand, we may be able to improve the precision of the estimated relationships between the explanatory variables and the outcome variables by combining items. On the other hand, we may lose some information associated with the individual items if we combine them. Also, estimation results may be sensitive to the way in which we combine the items. With these considerations in mind, we conduct several types of multivariate analyses.

Single-equation specifications. One general multivariate approach is to apply standard single-equation statistical techniques to the summary measures that we have already constructed. For instance, to examine food hardships, we can use the food security scale described by Nord et al. (1999) as an outcome measure and estimate an ordered categorical model, like the ordered probit model, of whether households were food secure, food insecure without hunger and food insecure with hunger. Similarly, we could use the count measures of food hardships or other adverse events and model these with either an ordered categorical procedure or a simple regression procedure. The main advantages of the single-equation approach are that it combines information from the underlying items and that it is easy to apply. The disadvantages are that the approach relies on particular specifications of the outcome variables and that it may impose an inappropriate scaling on the outcomes.

Multiple-equation specifications. As our preferred statistical approach, we develop and estimate multiple-equation specifications for our three general well-being outcomes that jointly model (a) the behavioral processes relating the explanatory variables to a summary index measure of well-being and (b) the measurement processes relating each of the individual well-being items to the same index measure.

Behavioral model. Consider the model for food hardships. Suppose there is an underlying index for food hardships that depends on a set of observed variables, X_i, and a normally distributed unobserved variable, ε_i, with mean zero and variance σ_ε^2 such that

$$f_i^* = \beta X_i + \varepsilon_i \quad \text{where } \varepsilon_i \sim N(0, \sigma_\varepsilon^2).$$

This type of index specification is commonly used in single-equation binary models, like probit and logit models. The index implies that there is a continuous underlying distribution of food hardships.

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Measurement model. Suppose also that people's responses to each of the six discrete-outcome food security questions depend on the underlying index, a fixed threshold, δ_j, and a normally distributed random component, ν_{ji}, as follows:

$$
\begin{array}{lll}
q_{1i}^* = f_i^* + \nu_{1i} & Q_{1i} = 1 \text{ if } q_{1i}^* > 0, & = 0 \text{ otherwise} \\
q_{2i}^* = \lambda_2 f_i^* + \nu_{2i} & Q_{2i} = 1 \text{ if } q_{2i}^* > \delta_2, & = 0 \text{ otherwise} \\
q_{34i}^* = \lambda_{34} f_i^* + \nu_{34i} & Q_{3i} = 1 \text{ if } q_{34i}^* > \delta_3, & = 0 \text{ otherwise} \\
 & Q_{4i} = 1 \text{ if } q_{34i}^* > \delta_4, & = 0 \text{ otherwise} \\
q_{5i}^* = \lambda_5 f_i^* + \nu_{5i} & Q_{5i} = 1 \text{ if } q_{5i}^* > \delta_5, & = 0 \text{ otherwise} \\
q_{6i}^* = \lambda_6 f_i^* + \nu_{6i} & Q_{6i} = 1 \text{ if } q_{6i}^* > \delta_6, & = 0 \text{ otherwise}
\end{array}
$$

where $\nu_{ji} \sim N(0, 1)$, $Cov(\varepsilon_i, \nu_{ji}) = 0$, and $Cov(\nu_{ji}, \nu_{ki}) = 0$ for $j, k = 1, 2, 3, 5, 6$ and $j \neq k$. Higher values of the continuous index, f_i^*, increase the chances that a household will report a given problem. The thresholds for reporting specific problems—indicators of the severity of the problems—vary across the six items. The strength or relevance of the underlying index for a given problem also varies across items, depending on the size of the λ coefficient.

The specification is a variant of the Multiple Indicator Multiple Cause model that was developed by Jöreskog and Goldberger (1975). The main difference between their original specification and this one is that this one uses discrete-valued indicators, rather than continuous indicators, as the outcome measures. The model is diagrammed in Figure 2.

The model is implemented in the aML software package by specifying a system of four bivariate probit models and one ordered probit model that share a common random effect, ε_i. The relevant program code is shown in Appendix B. The aML package jointly estimates values for the index coefficients β, the index random variance σ_ε^2, the response thresholds δ_2, δ_3, δ_4, δ_5 and δ_6, and the response loadings λ_2, λ_{34}, λ_5 and λ_6 using maximum likelihood and applying the numerical quadrature technique of Butler and Moffitt (1982) to integrate out the common random effect.[3] Similar models are specified for other adverse events and for the changes in subjective assessments of well-being.

As with the single-equation specification, the MIMIC model combines all of the information from the different indicators. However, it has several advantages relative to the single-equation specification. First, instead of imposing an ad hoc scaling on the well-being index, the multiple-equation specification allows the scaling to be determined as part of the measurement component of the model in the estimation process. Second, the procedure allows for differences in the amount of random variance or response error associated with each item in the measurement component of the model. This is done through the λ parameters, which are inversely related to the amount of item-specific variance. Third, although the model is written in terms of a single index, there are several ways to extend the model to allow multiple indices. Thus, we can easily test the single-index restriction of the model.

[3] There are other ways to estimate MIMIC models for categorical data. Maddala and Trost (1981) developed a maximum likelihood estimator with a more general covariance structure between categorical indicators but that only considered three indicators. Browne and Arminger (1995) review other estimation methods, including a multi-stage marginal likelihood and minimum distance method.

The main disadvantage of the model is its complexity. Special software and procedures are needed to estimate the model. Also, it is difficult to interpret the coefficient estimates because of the non-linear specification and the use of multiple indicators. The coefficients can tell us whether a change in an explanatory variable is positively or negatively associated with the index. However, without additional computations, we cannot tell what the magnitude of the association is in relation to the probability of reporting a particular problem or in relation to the summary measures, such as the food security scale.

An alternative, related estimation approach with many of the advantages of the MIMIC model is the Rasch model (see, e.g., Wilde and Nord 2005). The Rasch model, which was used by the researchers who developed USDA's food security scale, is similar to the MIMIC model in that it relates multiple discrete outcomes to a single latent index. The Rasch model differs, however, in assuming that the unobserved determinants of the responses follow a logistic distribution rather than a normal distribution. The Rasch model is also more restrictive because it does not allow for differences in the response loadings. This restriction greatly simplifies the computation of the model; however, it effectively sets the amount of item-specific variation to be equal across outcomes. Initial tests of our MIMIC specifications rejected this equal-variance restriction for all three domains of well-being outcomes.

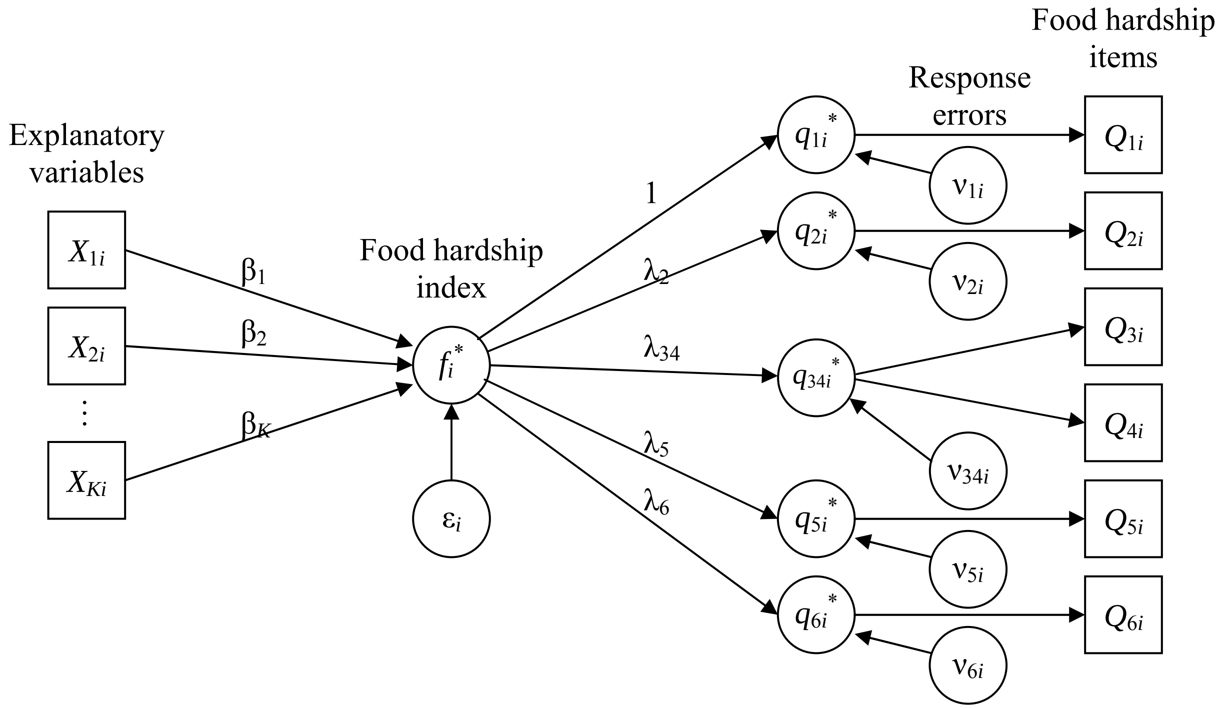
Estimation results. Food hardships. Table 3 lists coefficient estimates and standard errors from three multivariate models of the determinants of food problems. The first column of Table 3 reports results from an OLS model in which the dependent variable is a count (from 0 to 6) of the affirmative responses to the food security questions. The second column lists results from an ordered probit model of the food security scale (0 = food secure, 1 = food insecure without hunger evident, and 2 = food insecure with hunger evident), while the final column reports estimates from the MIMIC model of food hardships. Explanatory variables are listed along the left-hand side of the table. All of the models incorporate the same explanatory variables, and the results are very similar across specifications.

In each of the models, food hardships are estimated to have a negative association with total monthly non-assistance income. Although the associations are statistically distinguishable from zero, they are not especially strong. For instance, in the OLS model a change in monthly income from the bottom of our scale ($0) to the top of our scale (over $2,000) is associated with just one less affirmative food hardship response. Refusing or not being able to report an income amount is also negatively associated with reporting food hardships. The size of the association is comparable to that of changing the monthly income from $0 to $2,000. The results for missing incomes may reflect well-off families being less likely to report their incomes; they could also reflect a general reluctance by some people to report information about their well-being.[4]

Food stamp participation in the twelve months before the interview is positively associated with food problems. The coefficient is statistically significant in the OLS and ordered probit models and falls just short of being significant in the MIMIC model. The size of the association is not particularly large—participating in food stamps for an entire year is estimated

[4] The data from the survey do not indicate that there are missing values for any of the food security, adverse event, or subjective assessment questions. The total absence of item non-response in these variables is suspicious. The interviewers or coders may have included refusals and "don't knows" with the negative responses.

Figure 2. Diagram of Food Hardship MIMIC Model



to increase the number of affirmative responses by about one. The positive association likely reflects greater need among the households that received food stamps rather than an adverse effect of the food stamps themselves. Similar associations appear in descriptive analyses of these outcomes (see, e.g., Nord et al. 2002) and multivariate analyses that do not account for the endogeneity of food stamp receipt (see, e.g., Gundersen and Oliveira 2001; Ribar and Hamrick 2003).[5]

Food hardships also appear to increase with the age of the family respondent. The associations are statistically significant in the OLS and MIMIC models but not significant in the ordered probit model. None of the other explanatory variables has a statistically significant association with food hardships in any of the models.

Coefficient estimates for the threshold parameters, $\delta_2 - \delta_6$, in the MIMIC model give us one more way to assess people's food hardship reporting behavior. The six food security questions are intended to capture increasingly severe hardships, with the anticipated ordering being Q1-Q2-Q3-Q5-Q4-Q6 (Bickel et al. 2000).[6] When we examine the estimates, we see that this exact ordering is maintained, which provides evidence that respondents answered the food hardship questions in a reasonable way.

The bottom of the third column of Table 3 lists other coefficients from the MIMIC model. The parameters $\lambda_2 - \lambda_6$ are weights or loadings of the common latent index for answering questions $Q_2 - Q_6$ (the weight for Q_1 is normalized to one). The inverses of these parameters indicate the amount of the residual item-specific response variation for each of the questions (low values of λ indicate that there is a high level of item-specific response variation, while high values indicate a low level of variation). All of the λ coefficients are less than one; λ_{34} is significantly so. Thus, the residual item-specific variation is estimated to be lowest for question Q_1, which covers food not lasting and not being able to purchase more. For each of the questions, only about one-quarter to one-third of the unexplained variance is unique to the question itself; the rest is attributable to the component ε that is shared across questions.

An important issue that arises for the food security scale and for our multiple equation model is whether a single latent index is appropriate or whether multiple indices better describe the data (see, e.g., Johnson 2004; National Research Council 2005). A straightforward way to test for this is to respecify the thresholds ($\delta_2 - \delta_6$) so that they are linear functions of all of the observed variables in the latent index (e.g., let $\delta_2 = \Delta_2 X_i$). We did this to each of the thresholds and compared the fit of the resulting models to the model in Table 3. Based on likelihood ratio tests, we could not reject the single index specification.

<u>Other adverse events</u>. Table 4 lists results from three multivariate models of the determinants of non-TANF food stamp leavers experiencing other adverse events. The first

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[5] We experimented with 2SLS specifications to address the endogeneity of food stamp participation. However, we were unable to find instruments that could adequately predict food stamp receipt in the first stage of the procedure. Without predictive instruments, the 2SLS method is unreliable, so we do not report results from these specifications.
[6] The numbers for the questions (Q1, Q2, etc.) indicate the actual order in which they are asked in the survey. Even though question Q4 indicates a more severe condition than question Q5, it is asked earlier because it is a natural follow-up to question Q3.

Table 3. Multivariate Models of Food Hardships

	OLS model of count of problems	Ord. probit model of food insecurity	MIMIC model
Explanatory variables			
Age	0.0184*	0.0089	0.0222*
	(0.0108)	(0.0071)	(0.0117)
Male	-0.2619	-0.1709	-0.3765
	(0.2412)	(0.1583)	(0.2552)
Black	-0.2057	-0.1160	-0.1477
	(0.1551)	(0.0983)	(0.1642)
Completed high school	-0.1730	-0.1131	-0.2423
	(0.1656)	(0.1081)	(0.1785)
Second year of survey	-0.0544	-0.0533	-0.1582
	(0.1520)	(0.1001)	(0.1688)
Number of preschool age children	0.1531	0.0736	0.1338
	(0.1254)	(0.0823)	(0.1394)
Number of school age children	0.0001	0.0012	0.0086
	(0.0730)	(0.0500)	(0.0846)
Number of other adults	0.0836	0.0705	0.0268
	(0.1298)	(0.0791)	(0.1374)
Two-parent household	-0.1090	-0.0469	-0.1073
	(0.1627)	(0.1031)	(0.1724)
Total monthly income	-0.1391**	-0.0686*	-0.1528**
	(0.0623)	(0.0411)	(0.0703)
Income missing	-0.9496***	-0.4892**	-1.0823***
	(0.3156)	(0.2138)	(0.4044)
UI earnings 13-24 months ago	0.0132	0.0072	0.0153
	(0.0118)	(0.0077)	(0.0130)
FS participation in last year	0.9104**	0.5260*	0.8018
	(0.4495)	(0.2802)	(0.5002)
FS participation 13-24 months ago	-0.2641	-0.1676	-0.3223
	(0.2392)	(0.1567)	(0.2560)
Intercept, thresholds and loadings			
Intercept	2.1835***	0.1271	0.6790
	(0.6315)	(0.3435)	(0.5573)
τ_2		1.1683***	
		(0.0658)	
δ_2			0.6801***
			(0.1252)
δ_3			1.2246***

			(0.1172)
δ_4			1.5164***
			(0.1259)
δ_5			1.4776***
			(0.1490)
δ_6			2.8659***
			(0.5320)
λ_2			0.8919***
			(0.1624)
λ_{34}			0.6372***
			(0.1083)
λ_5			0.8185***
			(0.1474)
λ_6			0.9050***
			(0.2474)
σ_ε			1.6195***
			(0.2096)
R^2; log likelihood	0.040	-621.40	-1597.47

Note: Models estimated using a survey of former food stamp families in South Carolina (Richardson et al. 2003). Estimated standard errors appear in parentheses.
* Significant at .10 level. ** Significant at .05 level. *** Significant at .01 level.

column in the table lists coefficient estimates and standard errors from a probit model of the binary outcome of experiencing any adverse events. The second column lists results from an OLS model of the count (from 0 to 9) of adverse events, while the third column reports results from a MIMIC model of adverse events. The models include the same explanatory variables as the food hardship models in the previous table.

As with the food hardship results, the estimates from Table 4 indicate that households are less likely to report adverse events and report fewer events if they have high incomes or if they did not report an income. The coefficients on the income amount variable are statistically significant in all three specifications, and the coefficients on the missing income indicator are significant in two specifications. In the OLS model, each additional $1,000 in reported monthly income reduces the number of adverse events by roughly 0.4. Also like the food hardship results, participation in the Food Stamp Program is positively associated with adverse events; the coefficients are statistically significant in all three specifications. Again, it is difficult to give a causal interpretation to the participation results; the associations most likely reflect greater need among food stamp recipients.

Several significant associations appear in the models for adverse events that did not appear in the models for food hardships. One of these is a negative association for high school completion. More education may directly improve people's abilities to navigate difficult situations and avoid adverse outcomes. Education may also lead to higher permanent incomes and more stable employment and incomes, which would also contribute to fewer adverse events. Significant associations are also estimated for UI earnings from the year before leaving the Food Stamp Program. Earnings in this period are positively associated with reporting adverse events. The result is somewhat counter-intuitive because we expect that higher earnings would be associated with more resources, which should reduce the number of adverse events. However, higher earnings in earlier periods may have also led people to adjust their standard of living upward, causing them to perceive or actually experience more problems later.

One other difference in the multivariate models of adverse events and food hardships is that age is not a significant determinant of adverse events. The coefficients on age are all positive in Table 4, but they are not significantly different from zero.

For the MIMIC model, the events were not ordered by severity, so we observe both positive and negative estimates of the threshold values. The reporting thresholds for falling behind in rent (A2), falling behind in utilities (A3), going without electricity (A4), going without heat (A5), and losing telephone service (A7) are all significantly negative, indicating that these hardships are more likely to be reported than the reference event of having to move (A1). The estimated thresholds for reporting that a car or truck was taken away (A8) and that the household could not get needed medical care (A9) are positive, indicating that these hardships may be less likely to be reported than having to move; however, the estimates are not significantly greater than zero. When we examine the λ terms, there appears to be significantly less item-specific variation associated with reporting losses of electricity and heat and significantly more variation associated with reporting problems getting medical care than with reporting having to move. Reports of all of the other adverse events have roughly the same item-specific variation as the reference problem of having to move—the λ parameters for these events are all statistically indistinguishable from one.

Changes in subjective assessments of well-being. Table 5 lists results from multivariate models of the determinants of the parents in food stamp leaver families adopting more negative assessments of their life circumstances. For these outcomes, we were initially less sure that the responses could be categorized by a single latent variable. Also, because there are only three outcomes to consider, we could be more flexible in the type of models that we estimated. Accordingly, we decided to fit a system of correlated probit models for the three subjective assessment outcomes. The system includes separate models and, hence, separate indices for each outcome. It also allows for an unrestricted set of correlations among the unobserved determinants. Thus, the specification represents an unrestricted mean and covariance structure for the set of outcomes. The coefficient estimates and standard errors from the models in this system are reported in the first three columns of Table 5. We also estimated a MIMIC model for the changes in subjective assessments, which imposed a single-index restriction on the mean and covariance structure. Results from the MIMIC specification are reported in the last column of Table 5. A comparison of results from the two specifications helps to illustrate some of the trade-offs associated with the single- and multiple-index modeling approaches.

In the models for the specific outcomes and in the MIMIC model, the categorical variable for the family's monthly income amount and the indicator for not reporting an income are estimated to be significantly negatively associated with forming more negative assessments. The results are similar to those for food hardships and other adverse events and indicate that concerns and worries grew more among parents with fewer resources.

The number of preschool-age children is estimated to be associated with parents assessing their situation more negatively. The coefficients are significant in the individual equation for parents feeling worse about the previous year's changes and in the MIMIC specification. The results demonstrate one of the advantages of the MIMIC approach. By combining information from the three outcomes, the MIMIC model produces a more precise estimate of the relationship between small children and subjective assessments. In this case, the *p*-values of the coefficients from the individual models for feeling worse, worrying more, and feeling more stress are .07, .10 and .11, respectively, while the *p*-value for the coefficient from the MIMIC model is .04. The improvement in precision is reflected in the reduction in the estimated standard error in the MIMIC model, which is only one-half as large as the corresponding standard error from the individual model for feeling worse.[7]

There are several possible explanations for the association between small children and changes in assessments. In particular, we hypothesize that families with small children have larger financial and consumption needs than other families. We also expect that families with small children would face greater time pressures and more complex household management problems than other families. While the results from the negative assessment models are consistent with all of these effects, the lack of significant findings from the food hardship and

[7] Because of the way in which the MIMIC model is parameterized, the coefficients in the MIMIC model are directly comparable to the coefficients from the probit model for feeling worse but not directly comparable to the coefficients from the other two models.

Table 4. Multivariate Models of Other Adverse Events

	Probit model of any events	OLS model of count of events	MIMIC model
Explanatory variables			
Age	0.0030	0.0030	0.0031
	(0.0081)	(0.0103)	(0.0043)
Male	-0.0796	-0.0002	0.0569
	(0.1723)	(0.2304)	(0.0945)
Black	-0.1082	-0.0937	-0.0259
	(0.1169)	(0.1482)	(0.0696)
Completed high school	-0.3542**	-0.3832**	-0.2017***
	(0.1282)	(0.1582)	(0.0768)
Second year of survey	0.1504	0.1237	-0.0205
	(0.1139)	(0.1453)	(0.0704)
Number of preschool age children	0.0708	0.0171	0.0680
	(0.0992)	(0.1198)	(0.0611)
Number of school age children	0.0019	-0.0016	0.0218
	(0.0551)	(0.0697)	(0.0279)
Number of other adults	-0.0953	0.0402	-0.0528
	(0.0969)	(0.1240)	(0.0740)
Two-parent household	-0.0689	0.1203	0.1207
	(0.1217)	(0.1555)	(0.0784)
Total monthly income	-0.1029**	-0.1928***	-0.1109***
	(0.0456)	(0.0595)	(0.0315)
Income missing	-0.2689	-0.9001***	-0.3929**
	(0.2365)	(0.3015)	(0.1708)
UI earnings 13-24 months ago	0.0177**	0.0243**	0.0150***
	(0.0083)	(0.0112)	(0.0056)
FS participation in last year	0.7596**	1.6652***	0.8553***
	(0.3550)	(0.4294)	(0.2328)
FS participation 13-24 months ago	-0.0734	-0.1322	-0.1647
	(0.1749)	(0.2286)	(0.1182)
Intercept, thresholds and loadings			
Intercept	0.8826**	1.9658***	-1.3945***
	(0.3999)	(0.6033)	(0.2591)
δ_2 (fell behind in rent)			-1.5226***
			(0.3406)
δ_3 (fell behind utilities)			-1.9615***
			(0.3752)

δ_4 (went without electricity)			-2.9535**
			(1.4164)
δ_5 (went without heat)			-3.3318*
			(1.7826)
δ_6 (water cut off)			-0.2063
			(0.4264)
δ_7 (telephone cut off)			-0.8533***
			(0.2532)
δ_8 (car/truck taken away)			0.2745
			(0.3104)
δ_9 (could not get medical care)			0.2997
			(0.2226)
λ_2 (fell behind in rent)			1.1512***
			(0.2527)
λ_3 (fell behind utilities)			1.2832***
			(0.2784)
λ_4 (went without electricity)			4.6246***
			(1.4861)
λ_5 (went without heat)			6.7177***
			(2.3220)
λ_6 (water cut off)			1.4443***
			(0.3671)
λ_7 (telephone cut off)			0.8969***
			(0.1926)
λ_8 (car/truck taken away)			0.8074***
			(0.2428)
λ_9 (could not get medical care)			0.6471***
			(0.1735)
σ_ε			0.7229***
			(0.1320)
R^2; log likelihood	-384.16	0.066	-1597.47

Note: Models estimated using a survey of former food stamp families in South Carolina (Richardson et al. 2003). Estimated standard errors appear in parentheses.
* Significant at .10 level. ** Significant at .05 level. *** Significant at .01 level.

adverse events models suggests that time pressures and household management issues are the most likely explanations.

A similar pattern appears for the number of adults, which is estimated to have a significant positive coefficient in the MIMIC model and in the individual model for feeling more stress but an insignificant coefficient in the two other individual outcome models. The estimated coefficients for other adults are less uniform across the individual specifications than the coefficients for small children—in particular, the coefficient for other adults is very close to zero in the model for feeling worse. Besides their contribution to financial resources, which the income variables already account for, more adults would add to the time and home production resources of a household but would also add to the needs of the household, increase the complexity of managing the household, and possibly lead to more conflict. The estimates from Table 5 are consistent with these latter explanations.

The coefficient for a male respondent is negative and significant in the probit model for worrying more, negative and insignificant in the model for feeling more stress, and approximately zero in the model for feeling worse. The coefficient is negative in the MIMIC specification but falls just short of being statistically significant (p-value = .11). The results for other adults and gender point to one potential drawback of single index specifications, like the MIMIC model. A single index model may mask differences in the estimated impacts of explanatory variables across outcomes. In this case, because of the large standard errors on the coefficients, it is not clear whether the differences in the coefficient values across the individual outcome models are actually significant (e.g., the 95 percent confidence interval around the coefficient on the male gender variable is consistent with large negative impacts).

As mentioned, the three-equation system for the individual assessment outcomes includes an unrestricted set of correlation coefficients. These are all estimated to be significantly positive. The correlation in the unobserved determinants of worrying more and feeling stress is especially strong. The findings of significantly positive correlations among all of the outcomes are consistent with the single index restriction.

In the MIMIC model, the subjective assessments of worrying more and feeling more stress have significantly lower reporting thresholds than feeling worse, which suggests that these are less severe events. The MIMIC estimates also reveal that reports of worrying have less item-specific variation than reports of feeling worse and that reports of stress have less item-specific variation still.

Finally, when we compare the log likelihood values of the three-equation system and the MIMIC specification, we see that the MIMIC restrictions result in a relatively modest degradation in the fit of the model. A test of the MIMIC restrictions indicates that they would be rejected at a 10 percent confidence level but not at a 5 percent confidence level (the p-value is .08).

Table 5. Multivariate Models of Changes in Subjective Assessments of Well-Being

	Trivariate probit model			MIMIC model
	Feel worse	Worry more	More stress	
Explanatory variables				
Age	0.0149	0.0050	0.0098	0.0068
	(0.0099)	(0.0079)	(0.0080)	(0.0048)
Male	-0.0154	-0.3242*	-0.2550	-0.1858
	(0.2172)	(0.1743)	(0.1814)	(0.1159)
Black	0.0175	-0.0119	-0.0351	-0.0172
	(0.1472)	(0.1146)	(0.1129)	(0.0685)
Completed high school	-0.1854	-0.0562	-0.1781	-0.1061
	(0.1524)	(0.1193)	(0.1195)	(0.0752)
Second year of survey	0.0541	-0.1537	0.0930	0.0070
	(0.1558)	(0.1107)	(0.1115)	(0.0679)
Number of preschool age children	0.1946*	0.1532	0.1448	0.1186**
	(0.1069)	(0.0933)	(0.0914)	(0.0577)
Number of school age children	0.0497	0.0619	0.0259	0.0305
	(0.0624)	(0.0548)	(0.0545)	(0.0321)
Number of other adults	0.0038	0.1295	0.2179**	0.1203**
	(0.1048)	(0.1028)	(0.0966)	(0.0579)
Two-parent household	-0.1239	0.1462	0.0940	0.0573
	(0.1503)	(0.1194)	(0.1166)	(0.0732)
Total monthly income	-0.1889***	-0.1991***	-0.1190***	-0.1159***
	(0.0602)	(0.0463)	(0.0446)	(0.0325)
Income missing	-0.5006*	-0.6476***	-0.8226***	-0.5482***
	(0.2922)	(0.2301)	(0.2420)	(0.1704)
UI earnings 13-24 months ago	0.0038	0.0082	0.0044	0.0040
	(0.0105)	(0.0088)	(0.0089)	(0.0050)
FS participation in last year	0.3068	0.3073	0.0832	0.1520
	(0.4136)	(0.3349)	(0.3337)	(0.1962)
FS part. 13-24 months ago	-0.3485	-0.0907	0.2530	0.0567
	(0.2414)	(0.1735)	(0.1726)	(0.1074)
Intercept, thresholds and loadings				
Intercept	-0.9082*	0.3896	-0.2907	-1.3009***
	(0.4762)	(0.3784)	(0.3754)	(0.2402)
ρ_{12}, ρ_{13}, ρ_{23}	0.2942***	0.5274***	0.6784***	
	(0.0849)	(0.0744)	(0.0423)	
δ_2 (worry more about family)				-2.4349***
				(0.5073)

δ_3 (feel more stress)		-4.0972**
		(1.7842)
λ_2 (worry more about family)		1.7554***
		(0.4100)
λ_3 (feel more stress)		3.2874**
		(1.4402)
σ_ε		0.6117***
		(0.1011)
log likelihood	-1015.83	-1035.47

Note: Models estimated using a survey of former food stamp families in South Carolina (Richardson et al. 2003). Estimated standard errors appear in parentheses.
* Significant at .10 level. ** Significant at .05 level. *** Significant at .01 level.

5. Discussion

This study has used survey data from a sample of non-TANF food stamp leaver families linked with administrative data on earnings and food stamp receipt to examine characteristics of the families that are associated with three domains of well-being outcomes: food hardships, other adverse events, and subjective assessments of life changes. Each of the well-being domains is measured by several questions in the survey. The study follows the approach of many other investigations and examines summary measures of the well-being outcomes, including a food security scale, an indicator for experiencing any hardships, and counts of different types of hardships.

However, the study also goes beyond other research in this area by developing and estimating MIMIC models of well-being outcomes. Each MIMIC specification combines a measurement model relating the categorical responses to different questions to an underlying indicator of well-being with a behavioral model that describes how explanatory variables like a family's income, earnings history and demographic characteristics influence that same indicator. The empirical analyses using the standard and MIMIC approaches produce a number of interesting substantive and methodological findings; before discussing these, however, it is useful to review some of the limitations and qualifications of the analysis.

Limitations and qualifications. Data issues. An important limitation of our study arises from the survey and data that we use. The sample that forms the basis for our empirical analysis is selective in several crucial respects. First, the sample was purposefully limited to families with children and further limited to food stamp leavers who had not participated in TANF while receiving food stamps. Second, the outcomes at the center of the study were only measured among families who were not receiving food stamps one year after leaving the program. Third, even though response rates were excellent for this type of survey, a non-trivial fraction of households (30 percent) either could not be contacted or refused to participate. Fourth, the surveys were only conducted with families with working telephones (while this may seem like a minor issue, recall that one of the hardships that the survey records is whether a household lost phone service). Lastly, the survey was conducted in a single state with a unique set of economic, demographic and programmatic circumstances. The constellation of selection issues means that caution should be used in generalizing the findings to other populations, including the food stamp caseload as a whole.

Within the survey itself there are also several questions regarding the reliability and measurement of key variables. For instance, we were able to compare families' self-reports of incomes with their earnings records from the UI system. Just over half the families who reported receiving no income at all actually had UI earnings in the same quarter as the survey. In fact, the average amount of UI earnings for this group was actually *higher* than UI earnings for households who reported small but positive amounts of income. UI earnings did not increase consistently with reported income. Another troubling feature in the survey is the apparent lack

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of any item non-response for the food hardship, adverse event and subjective assessment questions, which leads us to believe that "don't knows" and refusals may have been coded as negative responses. The difficulty, of course, with mismeasurement is that it generally leads to weaker estimates of associations between variables and thus reduces the ability to draw inferences from the analyses.

Causality. Another limitation of our study is that the explanatory variables include several behaviorally-determined measures, such as incomes, earnings, food stamp participation, and family structure. The estimated relationships between these measures and the well-being outcome measures could reflect direct causal impacts of the explanatory variables. However, they could also reflect reverse causal relationships, such as less chaotic home situations allowing people to work and earn more. The estimated relationships could also be confounded by influences from other unmeasured factors, including unmeasured needs and subjective standards. The relatively large number of behaviorally-determined variables, problems in measurement for some of the variables, and the modest size of the sample precluded us from addressing this issue further. As a consequence, the relationships should be interpreted as evidence of associations and not necessarily as evidence of causal links.

Substantive findings. Family income. The study's most consistent finding is that families are less likely to experience and perceive hardships as their monthly incomes rise. This association appears in our descriptive analyses and in every multivariate specification for every well-being outcome. The result has been reported in other studies, and the reason for it is intuitive—families with more financial resources are better able to meet their food, housing, health care and other material needs than families with fewer resources.

While the sign of the association is not surprising, the small magnitude of some of the estimated relationships may be. The magnitudes are most easily judged in the OLS count models in which relatively large changes in income appear to help families avoid, at most, one hardship on average. One explanation, which we have already discussed, is that there is some misreporting in the income variable; the resulting measurement error would bias the estimates of the associations toward zero—that is, toward findings of no relationships or weak relationships. While measurement error is certainly present, we cannot dismiss the finding altogether. Several other researchers, including Gundersen and Ribar (2005), Nord and Brent (2002) and Ribar (2005), who have examined other data and not only looked at the direction but also the magnitudes of relationships between financial resources and well-being have reported similar results.

Food stamp participation. Leaver families who returned to the Food Stamp Program (but who left again before the survey was conducted) suffered more food hardships and other adverse events than families who remained independent of the program. It is doubtful that program participation itself caused these negative outcomes. More likely, unmeasured increases in families' needs, which would increase hardships but also increase program participation, account for the estimated relationship.

Earnings history. Another seemingly incongruous finding is that families who had higher earnings during the year before they initially left the Food Stamp Program reported more adverse events than families with lower earnings. This result is puzzling because higher earnings, even a year earlier and holding current income constant, should have helped the families to either pay bills, pay debts or put aside money—any of which would have reduced the probability of future hardships. The most plausible explanation for the result is that the families adjusted either their notions of what constitutes an appropriate standard of living (equivalently, adjusted their notions of what constitutes an appropriate threshold for reporting a problem) or took on more financial obligations which left them vulnerable to subsequent income changes. Kapteyn et al. (1988) and others have reported that changes in resources can lead people to change their reference levels of well-being.

Household structure. The study generates relatively little evidence that household structure—the living arrangements of the parents, the number and age distribution of the children, and the number of other adults—is strongly or consistently associated with well-being. No statistically significant associations were found for marriage. The number of small children was found to be related with assessing life changes more negatively, but the number of adults was also found to have the same association. These characteristics were not significantly associated with any other outcome.

Methodological findings. An innovation of our study is its use of MIMIC models to examine the characteristics of families that are associated with food hardships and other well-being outcomes. The study demonstrates that this type of model can be successfully employed in this context. We were also able to use the model to test a key assumption of the food security scale—namely, whether the items in the scale can be adequately represented by a single index. Formal specification tests failed to reject the single-index restriction for food hardships. Follow-up work should extend this analysis from the 6-item food security scale to the 18-item scale used in the Food Security Supplement of the Current Population Survey and other surveys.

Another methodological finding is that many estimated relationships between family characteristics and well-being outcomes are robust to whether simple summary measures or more elaborate MIMIC models are used. Results varied across well-being domains. However, there were few meaningful differences between the results from different statistical specifications within the domains. Therefore, even though the MIMIC approach has several advantages associated with it, the use of this approach does not lead to drastically different research findings. The results provide additional evidence that the single-index restriction is appropriate.

Policy implications. The findings of this study have several implications for food assistance policymakers. The first is that the well-being indicators considered here—self-reports of food hardships, material deprivations, and perceptions regarding life changes—may not be optimal for evaluating assistance programs. The self-reported measures undoubtedly incorporate objective components, but some of the observed relationships, such as the modest relationship between current income and hardships and the positive relationship between food stamp participation and food problems, may be partly explained in terms of subjective responses and relative standards (see, e.g., Easterlin 1974 and Hamermesh 2004). To the extent that subjectivity is present, it would be difficult to determine whether the relationships that we observe reflect associations with the objective components of the measures, the subjective components, or both. The results from the earnings history measure further suggest that changes in resources in one period may alter people's perceptions or standards of well-being in other periods. If the subjective components of these measures are continually evolving, policymakers who use the measures may be chasing a moving set of targets. Until we know more about the extent of subjectivity in self-reported hardship measures, policymakers should be cautious in using them to evaluate programs and should consider supplementing them with more objective criteria, such as direct measures of expenditures and consumption.

Putting the quality and utility of the measures aside, there are implications of the finding that income is a correlate of well-being. Supports for families leaving the Food Stamp Program that help them to earn money and maintain employment are likely to produce positive well-being outcomes. Conversely, policies and sanctions that remove families from the food stamp rolls without providing adequate income supports are likely to increase food hardships and material deprivations. Although many of the food stamp leavers in our sample, and elsewhere, were successful in securing reasonable incomes, there was still a sizeable minority of families who were jobless and/or had low-incomes and thus faced an especially high risk of other hardships. Policies to increase incomes might have reduced these risks.

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Appendix A. Comparison of Self-reported and Administrative Information on Income, Employment and Earnings

	Any UI-covered employment		UI-covered earnings	
	Last quarter	Not in last quarter but 2-4 quarters ago	Last quarter	Last year
Total monthly income				
$0	0.52	0.15	$1,556	$6,306
$1-$499	0.56	0.15	$1,185	$4,742
$500-$999	0.67	0.09	$1,969	$7,499
$1000-$1499	0.72	0.07	$2,594	$9,563
$1500-$1999	0.67	0.08	$2,679	$9,448
over $2000	0.65	0.15	$2,486	$8,912
Don't know/refused	0.60	0.10	$2,132	$7,547
Work status				
Currently working	0.79	0.07	$2,861	$10,365
Currently not working, but worked in last year	0.67	0.22	$1,578	$6,682
Did not work in last year	0.18	0.09	$438	$1,716

Note: Statistics calculated from survey of former food stamp families in South Carolina (Richardson et al. 2003).

Appendix B. aML Code for the MIMIC Specification for Food Hardships

```
define regressor set BetaX;
   var = 1 age male black hsormore survyear cpreschn cschage
         oth_adlt married inc_amt inc_miss piuilg2 fsdaylg1 fsdaylg2;

define normal distribution; dim=1; number of integration points = 15;
   name = eps;

define parameter delta2;

define parameter lambda2;

define vector q34cut; dim=2;

define parameter lambda3;

define parameter delta5;

define parameter lambda5;

define parameter delta6;

define parameter lambda6;

probit model;
   outcome = q1;
   model = regset BetaX + intres(draw=1, ref=eps);

probit model;
   outcome = q2;
   thresholds = delta2;
   model = par lambda2 * regset BetaX
           + par lambda2 * intres(draw=1, ref=eps);

ordered probit model;
   outcome = q3+q4 q3+q4+1;
   thresholds = q34cut;
   model = par lambda3 * regset BetaX
           + par lambda3 * intres(draw=1, ref=eps);

probit model;
   outcome = q5;
   thresholds = delta5;
   model = par lambda5 * regset BetaX
           + par lambda5 * intres(draw=1, ref=eps);

probit model;
   outcome = q6;
   thresholds = delta6;
   model = par lambda6 * regset BetaX
           + par lambda6 * intres(draw=1, ref=eps);
```